

PATENT ABSTRACTS OF JAPAN

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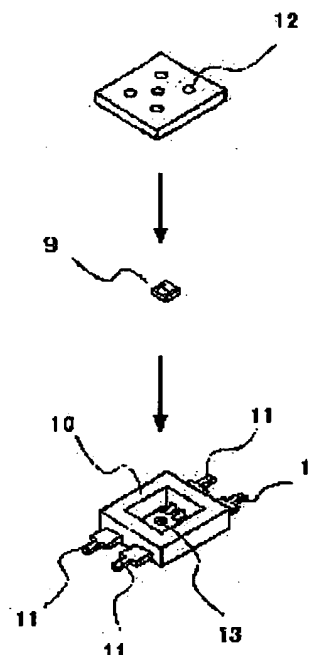
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(54) ELECTRIC HEATER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an electric heater with a small fluctuation in characteristics caused by a temperature increase.

SOLUTION: An air pit 13 is provided on a bottom part of a package 10 that contains a micro sensor chip 9. Thus provided electric heater has a small fluctuation in characteristics caused by a temperature increase as a warmed air between a heater part and the package 10 is circulated with the open air through the air pit 13 to prevent the temperature increase of the air inside the package 10.



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CLAIMS

[Claim(s)]

[Claim 1] On a silicon substrate (1), the 1st electric insulation thin film layer (2) is formed. The heater section (3) is formed on this 1st electric insulation thin film layer (2). In the electric heater which comes to contain the micro sensor chip (9) which the silicon substrate (1) located in the lower part of this heater section (3) is removed, and has the cavernous section (8) in a package (10) The electric heater characterized by preparing an air hole (13) in the pars basilaris ossis occipitalis of a package (10) located in the lower part of said heater section (3).

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the electric heater which mounted in the package etc. the micro heater which applies a silicon processing technique, a thin film technology, etc., and is produced.

[0002]

[Description of the Prior Art] The electric heater by the conventional technique is explained with reference to drawing 2 and drawing 3 . In addition, drawing 2 is the decomposition perspective view of an electric heater. The explanatory view of the micro sensor chip which contains drawing 3 in the electric heater, and drawing 3 (a) are the schematic diagrams of the heater at which the top view of a micro sensor chip and drawing 3 (b) have the A-A sectional view of drawing 3 (a), and drawing 3 (c) has the polar zone and the heater section.

[0003] The production procedure of the electric heater by the conventional technique is as follows.

[0004] First, the production procedure of the micro sensor chip built in an electric heater is explained.

[0005] ** As shown in drawing 3 , form the 1st electric insulation thin film layer 2 which consists of a monolayer which consists of SiO₂ film etc. with a spatter, a CVD method, etc., or two or more layers on a silicon substrate 1 at about 1.5-micrometer thickness.

[0006] ** Form the heater section 3 and the 1st polar zone 4 which consist of platinum etc. by a spatter etc. on the 1st electric insulation thin film layer 2.

[0007] ** Form the 2nd electric insulation thin film layer 5 which consists of monolayers, such as SiO₂ film, or two or more layers with a spatter, a CVD method, etc. on the heater section 3 at about 1.5-micrometer thickness.

[0008] ** Form the induction section 6 which consists of inductors, such as a gas inductor, a temperature inductor, and magneto induction matter, with a spatter, a CVD method, etc. after forming the 2nd polar zone 7 which consists of a conductive ingredient for measuring the electrical property (an impedance, capacitance, inductance) of an inductor by a spatter etc. on this 2nd electric insulation thin film layer 5.

[0009] ** Remove the silicon substrate 1 of the lower part of the heater section 3 by etching of a potassium hydroxide (KOH) etc., and form the cavernous section 8.

[0010] Thereby, the matter in connection with heat conduction becomes only the 1st electric insulation thin film layer 2, the 2nd electric insulation thin film layer 5, and the induction section 6 around the heater section 3 except air, and the induction section 6 can be heated efficiently. In addition, the surrounding structure of this heater section 3 and the heater section 3 is made

also to configurations, such as the structure of cross linkage, cantilever structure, and diaphragm structure.

[0011] Next, the production procedure of the electric heater using the micro sensor chip produced by **** is explained.

[0012] ** As shown in drawing 2 , mount the micro sensor chip 9 in a package 10, and paste up.

[0013] ** Carry out electrical connection for the 1st polar zone and 2nd polar zone of the micro sensor chip 9 to the terminal 11 of a package 10 by wirebonding etc.

[0014] ** Put covering 12 on the package 10 with which the micro sensor chip 9 was built in, and make it fix to it.

[0015] An electric heater is obtained according to the above process. Thus, since the heater section 3 and heater section 3 circumference can process it very small and can make heat capacity small, the obtained electric heater has the features that the temperature flattery nature of the induction section 6 accompanying change of ambient temperature is high.

[0016]

[Problem(s) to be Solved by the Invention] However, at the time of use, under the effect of the heat of the heater section 3, the temperature of the air in a package 10 rose gradually, and there was a fault of causing property fluctuation.

[0017] Therefore, this invention solves this fault, is preventing the temperature rise of the air in a package 10, and aims at offering the electric heater which can make property fluctuation small.

[0018]

[Means for Solving the Problem] According to this invention, an air hole is prepared in the heater section and the lower part of the package which counters, and the electric heater which enabled it to radiate heat out of a package of the heat generated at a heater is obtained.

[0019] that is, the 1st electric-insulation thin film layer forms this invention on a silicon substrate -- having -- this -- in the electric heater which comes to contain in a package the micro sensor chip which the silicon substrate which the heater section is formed on the 1st electric insulation thin film layer, and is located in the lower part of this heater section is removed, and has the cavernous section, it is the electric heater which prepared the air hole in the pars basilaris ossis occipitalis of a package located in the lower part of said heater section.

[0020]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.

[0021] The decomposition perspective view of the electric heater of the gestalt of operation of this invention is shown in drawing 1 . In addition, since the structure and the production procedure of a micro sensor chip in this invention are the same as usual, detailed explanation is omitted.

[0022] In drawing 1 , the micro sensor chip 9 produced in the same procedure as usual is contained by the package 10 which formed the air hole 13 in the lower part, it carries out wirebonding of the 1st polar zone and 2nd polar zone of the micro sensor chip 9 to the terminal 11 of a package 10 as usual, and electrical connection is carried out.

[0023] Next, covering 12 is put on a package 10 and it fixes to it.

[0024] Thus, the electric heater of this invention obtained has the small property fluctuation by the temperature rise, in order that the air got warm between the heater section and a package 10 at the package 10 by having formed the air hole 13 may circulate with the open air through an air hole 13 and may prevent the temperature rise of the air in a package 10.

[0025] Moreover, if the package used by this invention is similarly used for sensors, such as a

gas sensor, a humidity sensor, a temperature sensor, and a flow sensor, a highly efficient sensor with small property fluctuation will be obtained.

[0026]

[Effect of the Invention] As mentioned above, as explained, according to this invention, the small electric heater of the property fluctuation by temperature is obtained.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The decomposition perspective view of the electric heater of the gestalt of operation of this invention.

[Drawing 2] The decomposition perspective view of the conventional electric heater.

[Drawing 3] The explanatory view of the micro sensor chip built in the electric heater. Drawing 3 (a) is the top view of a micro sensor chip. Drawing 3 (b) is the A-A sectional view of drawing 3 (a). Drawing 3 (c) is the schematic diagram of the heater which has the polar zone and the heater section.

[Description of Notations]

1 Silicon Substrate

2 1st Electric Insulation Thin Film Layer

3 Heater Section

4 1st Polar Zone

5 2nd Electric Insulation Thin Film Layer

6 Induction Section

7 2nd Polar Zone

8 Cavernous Section

9 Micro Sensor Chip

10 Package

11 Terminal

12 Covering

13 Air Hole

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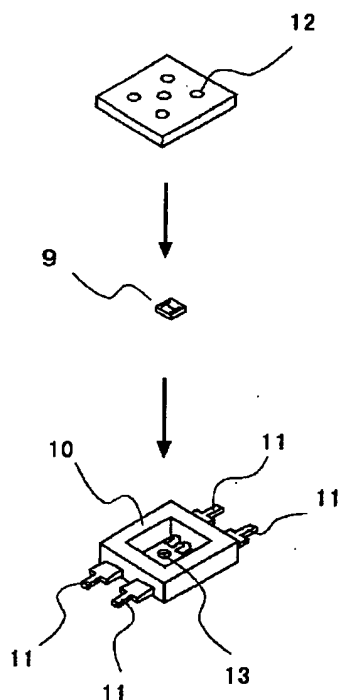
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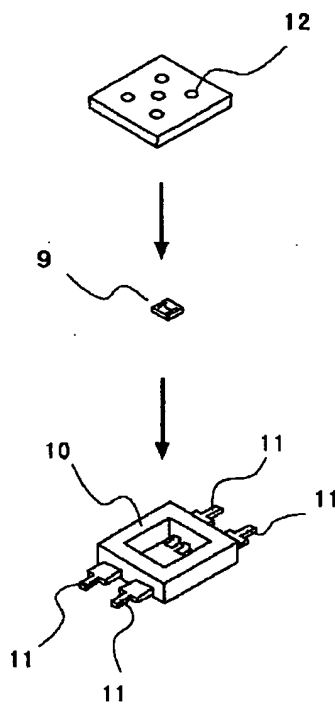
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DRAWINGS

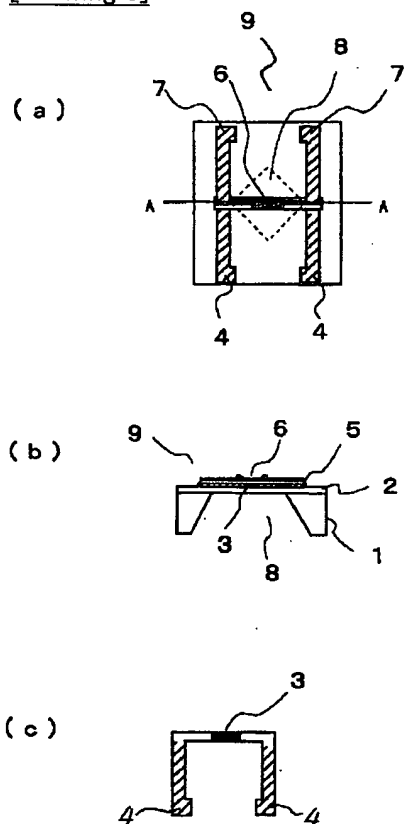
[Drawing 1]



[Drawing 2]



[Drawing 3]



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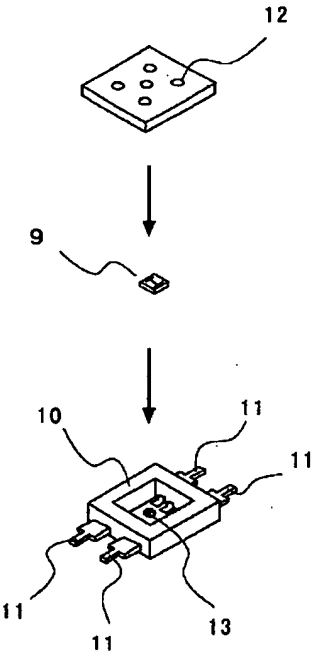
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(54) 【発明の名称】 電熱器

(57) 【要約】

【課題】 温度の上昇による特性変動の小さい電熱器を提供すること。

【解決手段】 マイクロセンサチップ9を収納するパッケージ10の底部に通気孔13を設けた電熱器。



【特許請求の範囲】

【請求項1】 シリコン基板(1)上に、第1の電気絶縁薄膜層(2)が形成され、該第1の電気絶縁薄膜層(2)上にヒーター部(3)が形成され、かつ、該ヒーター部(3)の下部に位置するシリコン基板(1)が取り除かれて、空洞部(8)を有するマイクロセンサチップ(9)をパッケージ(10)に収納してなる電熱器において、前記ヒーター部(3)の下部に位置するパッケージ(10)の底部に通気孔(13)を設けたことを特徴とする電熱器。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、シリコン加工技術、薄膜技術等を用いて作製されるマイクロヒーターをパッケージ等へ実装した電熱器に関する。

【0002】

【従来の技術】従来技術による電熱器について、図2及び図3を参照して説明する。なお、図2は、電熱器の分解斜視図である。図3は、電熱器に内蔵しているマイクロセンサチップの説明図、図3(a)は、マイクロセンサチップの平面図、図3(b)は、図3(a)のA-A断面図、図3(c)は、電極部及びヒーター部を有するヒーターの概略図である。

【0003】従来技術による電熱器の作製手順は、以下の通りである。

【0004】まず、電熱器に内蔵されるマイクロセンサチップの作製手順について説明する。

【0005】図3に示すように、シリコン基板1上に、例えば、スパッタ法、CVD法等でSiO₂膜等からなる単層あるいは複数層からなる第1の電気絶縁薄膜層2を約1.5μm厚に形成する。

【0006】第1の電気絶縁薄膜層2上にスパッタ法等で白金等からなるヒーター部3及び第1の電極部4を形成する。

【0007】ヒーター部3上にスパッタ法、CVD法等でSiO₂膜等の単層あるいは複数層からなる第2の電気絶縁薄膜層5を約1.5μm厚に形成する。

【0008】この第2の電気絶縁薄膜層5上に、感応物質の電気特性(インピーダンス、キャパシタンス、インダクタンス)を測定するための導電性材料からなる第2の電極部7をスパッタ法等で形成した後、ガス感応物質、温度感応物質、磁気感応物質等の感応物質からなる感応部6をスパッタ法、CVD法等で形成する。

【0009】ヒーター部3の下部のシリコン基板1を水酸化カリウム(KOH)等のエッチングにより取り除き、空洞部8を形成する。

【0010】これにより、ヒーター部3の周辺に熱伝導に関わる物質は、空気以外では、第1の電気絶縁薄膜層2と第2の電気絶縁薄膜層5と感応部6だけになり、感応部6を効率よく加熱できる。なお、このヒーター部3

とヒーター部3の周辺の構造体は、架橋構造、片持ち梁構造、ダイヤフラム構造等の形状にもできる。

【0011】次に、上述により作製されたマイクロセンサチップを用いた電熱器の作製手順について説明する。

【0012】図2に示すように、マイクロセンサチップ9をパッケージ10に実装し、接着する。

【0013】マイクロセンサチップ9の第1の電極部及び第2の電極部をパッケージ10の端子11にワイヤボンディング等で電気接続をする。

【0014】マイクロセンサチップ9が内蔵されたパッケージ10にカバー12をかぶせて固定させる。

【0015】以上の工程により、電熱器が得られる。このようにして得られた電熱器は、ヒーター部3及びヒーター部3周辺が、非常に小さく加工でき、熱容量を小さくできるため、周囲温度の変化に伴う感応部6の温度追従性が高いという特長がある。

【0016】

【発明が解決しようとする課題】しかしながら、使用時において、ヒーター部3の熱の影響で、パッケージ10内の空気の温度が、徐々に上昇し、特性変動を起こすという欠点があった。

【0017】従って、本発明は、かかる欠点を解決し、パッケージ10内の空気の温度上昇を防ぐことで、特性変動を小さくできる電熱器を提供することを目的とする。

【0018】

【課題を解決するための手段】本発明によれば、ヒーター部と対向するパッケージの下部に通気孔を設け、ヒーターで発生する熱をパッケージの外に放熱できるようにした電熱器が得られる。

【0019】即ち、本発明は、シリコン基板上に、第1の電気絶縁薄膜層が形成され、該第1の電気絶縁薄膜層上にヒーター部が形成され、かつ、該ヒーター部の下部に位置するシリコン基板が取り除かれて、空洞部を有するマイクロセンサチップをパッケージに収納してなる電熱器において、前記ヒーター部の下部に位置するパッケージの底部に通気孔を設けた電熱器である。

【0020】

【発明の実施の形態】以下、本発明の実施の形態について、図面を参照して説明する。

【0021】図1に、本発明の実施の形態の電熱器の分解斜視図を示す。なお、本発明でのマイクロセンサチップの構造及び作製手順は、従来と同様であるので、詳細な説明を省略する。

【0022】図1において、従来と同様の手順で作製されたマイクロセンサチップ9は、下部に通気孔13を設けたパッケージ10に収納され、従来と同様に、マイクロセンサチップ9の第1の電極部及び第2の電極部をパッケージ10の端子11にワイヤボンディングして電気接続される。

【0023】次に、パッケージ10にカバー12をかぶせて固定する。

【0024】このようにして得られる本発明の電熱器は、パッケージ10に通気孔13を設けていることにより、ヒーター部とパッケージ10間の暖まった空気が、通気孔13を通して外気と循環し、パッケージ10内の空気の温度上昇を防止するため、温度上昇による特性変動が小さい。

【0025】また、同様に、本発明で用いたパッケージをガスセンサ、湿度センサ、温度センサ、フローセンサ等のセンサに用いれば、特性変動の小さい、高性能なセンサが得られる。

【0026】

【発明の効果】以上、説明したごとく、本発明によれば、温度による特性変動の小さい電熱器が得られる。

【図面の簡単な説明】

【図1】本発明の実施の形態の電熱器の分解斜視図。

【図2】従来の電熱器の分解斜視図。

【図3】電熱器に内蔵されているマイクロセンサチップ*

*の説明図。図3(a)は、マイクロセンサチップの平面図。図3(b)は、図3(a)のA-A断面図。図3(c)は、電極部及びヒーター部を有するヒーターの概略図。

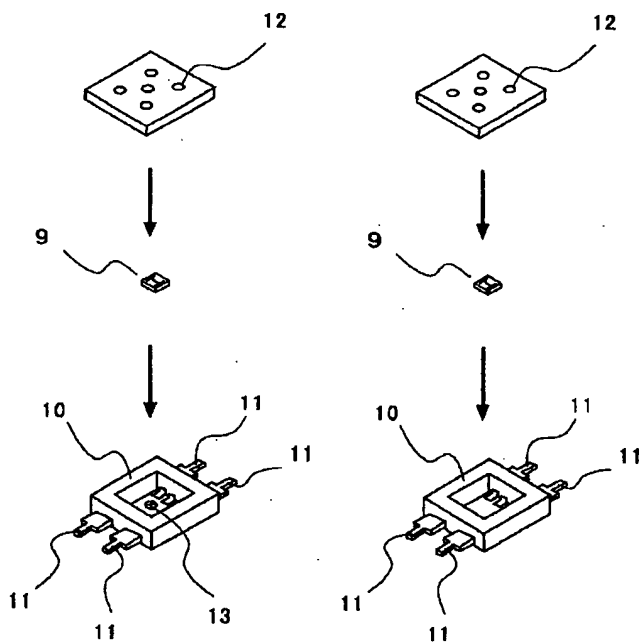
【符号の説明】

- 1 シリコン基板
- 2 第1の電気絶縁薄膜層
- 3 ヒーター部
- 4 第1の電極部
- 5 第2の電気絶縁薄膜層
- 6 感応部
- 7 第2の電極部
- 8 空洞部
- 9 マイクロセンサチップ
- 10 パッケージ
- 11 端子
- 12 カバー
- 13 通気孔

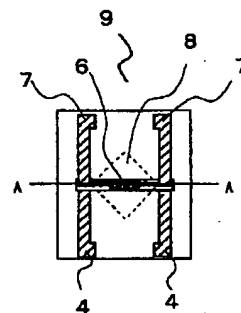
【図1】

【図2】

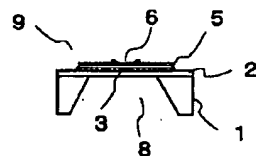
【図3】



(a)



(b)



(c)

